X-ray Studies of Interfaces and Interphases in Batteries

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While batteries are often described by their bulk characteristics, the electrode/electrolyte interface plays a key role in the safety, reversibility, and long term performance of the battery. The evolution of solid electrolyte interphase (SEI) species are poorly understood due to their inherent reactivity and the vacuum-based conditions required by many surface-sensitive probes. Hard x-ray scattering provides a complementary tool for analyzing SEI components at operating conditions with bulk-sensitivity. I will discuss how x-ray Raman scattering (XRS) provides a route for measuring low energy K-edges (Li, O, etc) with hard x-rays, yielding unambiguous spectra that can complement soft x-ray absorption and electron energy loss spectroscopy. This work highlights a unique feature of XRS: the ability to measure orbital hybridization using its *q*-dependence. Examples of SEI spectra in real electrodes will also be shown. Finally, I will describe how x-ray spectroscopy and scattering can also be coupled to isolate the species at well-defined interfaces, often with sub-nanometer sensitivity.

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